

The opinion in support of the decision being entered today was **not** written for publication and is **not** binding precedent of the Board.

Paper No. 19

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DAWN M. HOPPER, MINH V. NGO, and MARK S. CHANG

Appeal No. 2004-0660
Application No. 10/120,116

ON BRIEF

Before GARRIS, WARREN, and MOORE, Administrative Patent Judges.
GARRIS, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal from the final rejection of claims 1-11. The only other claims remaining in the application, which are claims 12-18, stand withdrawn from further consideration by the Examiner.

The subject matter on appeal relates to a method for filling isolation trenches during a semiconductor fabrication process by depositing a silicon-rich liner onto the isolation trenches and filling the isolation trenches with an oxide utilizing a biased high density plasma deposition process. This appealed subject

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matter is adequately illustrated by independent claim 1 and dependent claim 4 which read as follows:

1. A method for filling isolation trenches during a semiconductor fabrication process comprising the steps of:

- (a) depositing a silicon-rich liner onto the isolation trenches; and
- (b) filling the isolation trenches with an oxide utilizing a biased high density plasma deposition process.

4. The method of claim 1, wherein step(a) further includes the step of depositing a silicon-rich in-situ high density plasma liner in a non-biased environment.

The references set forth below are relied upon by the Examiner as evidence of obviousness:

Park et al. (Park)	6,326,282 B1	Dec. 4, 2001
Yew et al. (Yew)	6,228,742 B1	May 8, 2001
Fukumoto et al. (Fukumoto)	6,441,426 B1	Aug. 27, 2002
		(filed Jun. 16, 1999)

Vossen "Thin Film Processes," Academic Press, p. 54 (1978).

Wolf "Silicon Processing for the VSLI ERA," Lattice Press, Vol. 1 pp. 171-173, 191-193 (1986).

Wolf "Silicon Processing for the VSLI ERA," Lattice Press, Vol. 1, Second edition , pp. 795-796 (2000).

Claims 4 and 10 stand rejected under the first paragraph of 35 U.S.C. § 112. The Examiner considers these claims to be not enabled by the Appellants' disclosure with respect to the here claimed "non-biased" feature. Relying on prior art of record as support for his position, the Examiner argues that "all plasma

deposition systems are biased" and that "[i]t is unclear what type of plasma system is being used, or how a process that uses bias to deposit material is non-biased [as required by rejected claims 4 and 10]" (answer, page 4).

Claims 1-3, 6, 8 and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Park in view of Yew and Vossen.

Claims 4, 5, 10 and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Park, Yew and Vossen, as applied above, and further in view of Wolf.

Finally, claim 7 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Park, Yew and Vossen, as applied above, and further in view of Fukumoto.

On page 4 of the brief (also see page 2 of the reply brief), the Appellants set forth the following claim groupings:

Claims 1, 2, 3, 6, 8-9 form a first group.
Claims 5 and 11 form a second group.
Claims 4, 7 and 10 should not be grouped
together and should be considered separately.

We refer to the brief and reply brief and to the answer for a thorough discussion of the opposing viewpoints expressed by the Appellants and by the Examiner concerning the above noted rejections.

OPINION

For the reason which follow, we cannot sustain the Examiner's § 112, first paragraph, rejection of claims 4 and 10 or his § 103 rejection of claims 4 and 10, but we will sustain the Examiner's § 103 rejections of claims 1-3, 5-9 and 11.

In response to the § 112, first paragraph, rejection, the Appellants have submitted a declaration (i.e., paper no. 13½, filed with the brief on July 17, 2003) under 37 CFR § 1.132 by Dawn M. Hopper. According to the Appellants, "as indicated in the Declaration submitted herewith, a person of ordinary skill in the art would recognize that a non-biased high density plasma deposition process refers to not applying an external RF bias to the wafer" (brief, page 6). Thus, the Appellants do not challenge the Examiner's reliance on the Vossen reference of record that "substrates (even if they are grounded) are at a potential that is negative with respect to the plasma" (page 54) vis-à-vis the proposition that plasma deposition systems necessarily are biased. Rather, it is the Appellants' position that one having an ordinary level of skill in the art would consider the "non-biased" recitation in claims 4 and 10 as well as in the subject specification as referring to "not applying an external RF bias to the wafer" (brief, page 6).

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In the first full paragraph on page 9 of the answer, the Examiner replies to the above noted argument in the following manner:

The examiner is not rejecting the claims because it is not known to deposit without an external bias, but that depositing without a bias in a plasma system that requires a bias to create the plasma is contradictory. The specification as originally presented does not recite or teach without a bias as "not applying an external bias to the wafer". Further, even if one were to accept that non-biased means no external bias to the wafer, claim 4 clearly recites "a non-biased environment." This is broader than referring to the wafer alone. Claim 10 recites "a non-biased high density plasma process." This is also broader than referring to the wafer alone. Adding this meaning would change the scope of the invention as originally presented.

Under the circumstances recounted above, it is apparent that the pivotal question raised by the Examiner's § 112, first paragraph, rejection is whether the artisan would consider the "non-biased" feature recited in claims 4 and 10 and disclosed in the Appellants' specification as referring to the circumstance of "not applying an external RF bias to the wafer" (brief, page 6). While the Examiner is correct that the subject specification does not expressly teach this circumstance, the fundamental consideration is not the presence or absence of an express teaching in the specification but rather how the artisan would

have interpreted the specification and claims. With respect to this fundamental consideration, the § 1.132 declaration of record by one skilled in this art constitutes probative evidence that the artisan would interpret the "non-biased" feature under consideration in the manner urged by the Appellants. Such an interpretation would render the "non-biased" recitation of the specification and claims meaningful as well as enabled and operative. On the other hand, to regard "non-biased" as referring to a complete absence of bias, as the Examiner seems to urge, would be contradictory to what is known in the prior art (e.g., the Vossen reference) and thus nonsensical to the artisan.

Viewed from this perspective, the record before us supports a determination that the artisan would not interpret the Appellants' claimed and disclosed invention in a manner which would render it nonsensical, not enabled and inoperative but instead would interpret the "non-biased" feature in question as referring to "not applying an external RF bias to the wafer" (id.) in accordance with the Appellants' argument. As so interpreted, claims 4 and 10 would not be subject to the Examiner's enablement-based § 112, first paragraph, rejection since, as indicated above, "[t]he examiner is not rejecting the claims because it is not known to deposit without an external bias" (answer, page 9). As for the Examiner's above

quoted point that the recitation in claims 4 and 10 is "broader than referring to the wafer alone" (id.), this point relates to breadth rather than to enablement vis-à-vis practicing the here claimed invention by not applying an external RF bias to the wafer.

In light of the foregoing, we cannot sustain the Examiner's § 112, first paragraph, rejection of claims 4 and 10.

Concerning the § 103 rejection of independent claims 1 and 8 (and of non argued dependent claims 2, 3, 6, and 9), the Examiner correctly points out that Park discloses a method for filling isolation trenches during semiconductor fabrication wherein patentee "deposits a silicon-rich trench liner (114) of a thickness between 30-[sic] and 200 angstroms" (answer, page 5; also see lines 32-43 in column 4 of Park). Patentee's method also includes the subsequent step of filling the isolation trench with an oxide (e.g., see lines 53-65 in column 4). However, Park does not identify the specific process by which this filling step is achieved. As a consequence, the Appellants' independent claims distinguish over the Park reference by requiring that the filling step be achieved via "a biased high density plasma deposition process."

With respect to this distinction, the Examiner proffers the Yew and Vossen references as evidence that it was known in this art to provide isolation layers (i.e., to fill isolation trenches) via a high density plasma deposition process (e.g., see the paragraph bridging columns 2 and 3 of Yew) and that it was known in this art to effect plasma deposition via a process which is biased (see page 54 of Vossen). Thus, it is the Examiner's basic position that it would have been obvious for one having an ordinary level of skill in the art to effectuate the filling step of Park via a biased high density plasma deposition process in view of Yew and Vossen. In this manner, Park's filling step would have been achieved by way of a process evinced by Yew and Vossen to be known in the prior art as effective for this purpose.

The Appellants argue that "[t]he Examiner does not provide any objective motivation for modifying Park with Yew and Vossen to fill the isolation trenches with an oxide utilizing a biased high density plasma deposition process" (brief, page 8). This argument lacks discernable merit. The motivation in question arises from the simple fact that a specific process would have been required in order for an artisan to practice Park's filling step, and the Yew and Vossen references evince that a biased high density plasma deposition process of the type here claimed was recognized in the

prior art as effective for this purpose. To the extent that the Appellants may dispute this last mentioned recognition, we here emphasize that the admitted prior art descriptions by the Appellants in their specification (see the paragraph bridging pages 1 and 2, the paragraph bridging pages 4 and 5, the first full paragraph on page 5 and the paragraph bridging pages 5 and 6), in their drawing (see Figures 1A, 1B, 1C and 2) and in their brief (see the first full paragraph on page 3) all reflect that a biased high density plasma deposition process was known in the prior art as an effective technique for filling isolation trenches with an oxide.¹

In further support of their position that the § 103 rejection under review is improper, the Appellants advance the following argument in the paragraph bridging pages 11 and 12 of the brief:

Yew teaches a first isolation layer comprising silicon oxide to partially fill the trenches and a second isolation formed on the first isolation to fill completely the

¹ It is axiomatic that admitted prior art described by an Applicant may be used in determining the patentability of a claimed invention (see In re Nomiya, 509 F.2d 566, 571-72, 184 USPQ 607, 611-12 (CCPA 1975)) and that consideration of the prior art cited by the Examiner may include consideration of the admitted prior art described by an Applicant (see In re Davis, 305 F.2d 501, 503, 134 USPQ 256, 258 (CCPA 1962); compare In re Hedges, 783 F.2d 1038, 1039, 228 USPQ 685, 686 (Fed. Cir. 1986)).

trenches. However, by combining Park with Yew, the nitride layer 114 in Park would be replaced with a first isolation layer comprising silicon oxide. Since an isolation layer of silicon oxide would be formed on the thermal oxide layer 112 in Park, oxidation of the trench interior walls would not be prevented in the subsequent oxidation process in Park. That is, by combining Park with Yew, the principle of operation in Park would change and subsequently render the operation of Park to perform its purpose unsatisfactory. Therefore, the Examiner has not presented a *prima facie* case of obviousness for rejecting claims 1-3, 6 and 8-9.

As correctly noted by the Examiner, his rejection does not propose combining Park with Yew in the aforequoted manner, and the teachings of these references do not support such a combination. Indeed, an artisan would have been discouraged from combining these references in the manner discussed by the Appellants precisely because the resulting combination would "render the operation of Park to perform its purpose unsatisfactory" (*id.*).

In light of the foregoing, we will sustain the Examiner's § 103 rejection of claims 1-3, 6, 8 and 9 as being unpatentable over Park in view of Yew and Vossen.

We also will sustain the Examiner's § 103 rejection of claims 5 and 11 as being unpatentable over Park in view of Yew and Vossen and further in view of Wolf. Contrary to the Appellants' apparent belief, the artisan would have been motivated to deposit the

silicon-rich nitride liner of Park via a plasma enhanced chemical vapor disposition process in view of Wolf's clear teaching that such a process was known in the prior art as an advantageous, low-temperature technique by which to deposit a silicon nitride layer (e.g., see the last full paragraph on page 171, the last paragraph on page 191, and the paragraph bridging pages 192-193).

However, we cannot sustain the Examiner's corresponding § 103 rejection of claims 4 and 10. This is because we find nothing and the Examiner points to nothing in Wolf or in the other applied references which would have suggested depositing the silicon-rich nitride liner of Park in a non-biased manner as required by these claims. In this regard, we observe that the first full sentence on page 7 of the answer indicates that the Examiner has ignored the "non-biased" limitation of claims 4 and 10. This is completely inappropriate. In formulating a § 103 rejection, all claim limitations must be considered (regardless of whether or not they are supported by the specification). See In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970) and Ex parte Grasselli, 231 USPQ 393, 394 (Bd. App. 1983).

Finally, the § 103 rejection of claim 7 as being unpatentable over Park in view of Yew and Vossen and further in view of Fukumoto likewise will be sustained. As properly concluded by the Examiner,

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it would have been obvious for the artisan to practice the isolation trench forming method of Park during fabrication of semiconductor structure in the form of a flash memory array in view of Fukumoto's teaching that the formation of such trenches during fabrication of a flash memory array was known in the prior art. Again, the Appellants' contrary viewpoint lacks discernable merit. For example, their argument that an artisan would have combined the teachings of Park and Fukumoto in such a way as to "render the operation of Park to perform its purpose unsatisfactory" (brief, page 19) is unconvincing for reasons analogous to those discussed above (e.g., an artisan would have been discouraged from so combining these reference teachings precisely because such a combination would have rendered the operation of Park unsatisfactory).

In summary: we have not sustained either the § 112, first paragraph, rejection or the § 103 rejection of claims 4 and 10; however, we have sustained each of the § 103 rejections of the remaining claims on appeal.

The decision of the Examiner is affirmed-in-part.

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No time period for taking any subsequent action in connection
with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED-IN-PART

BRADLEY R. GARRIS)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
CHARLES F. WARREN)	APPEALS
Administrative Patent Judge)	AND
)	INTERFERENCES
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JAMES T. MOORE)	
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